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Statement of Miljöorganisationernas kärnavfallsgranskning (MKG) [Swedish NGO Office for Nuclear Waste Review] on Posiva Oy's application for an operating license for a repository for spent nuclear fuel

Miljöorganisationernas kärnavfallsgranskning (MKG) [Swedish NGO Office for Nuclear Waste Review] is a Swedish environmental organization working for and with the Swedish Society for Nature Conservation [Naturskyddsföreningen], the Swedish Friends of the Earth [Jordens Vänner] and other member organisations with issues that concern radioactive waste management. MKG was established in 2005 and has since then together with its member organisations participated in the consultation and licence review process for a repository for spent nuclear fuel in Sweden.

This is a statement from MKG on Posiva Oy's application for an operating license for a repository for spent nuclear fuel. The statement is also submitted in Swedish.

1. Background

The Finnish method for a repository system for spent nuclear fuel is based on the Swedish KBS method developed by the Swedish nuclear waste company SKB. In January 2022 the Swedish government approved a license application from SKB to build a repository for spent nuclear fuel at the Forsmark nuclear power plant. The application for construction had been submitted in March 2011 and after the government decision now has been made, further review and decisions on conditions will be taken by the Land and Environmental Court according to the Environmental Code and the Swedish Radiation Safety Authority (SSM) according to the Nuclear Activities Act. This process will take a further number of years and construction of the Swedish repository will likely not start until a bit after 2025.

Due to an expedited decision-making process compared to the one in Sweden, the Finnish construction license was granted in 2015 and the repository is soon ready for operation. The Finnish nuclear waste company Posiva Oy is now seeking an operational license after handing in a license application at the end of December 2021.

The decision of the Swedish government to approve the Swedish repository plans in January 2022 have been appealed to the Swedish Supreme Administrative Court (Högsta förvaltningsdomstolen) by the Swedish Society for Nature Conservation, MKG and a number of member organisations of MKG. This was done on April 27, 2022. The court will examine whether the government's decision was in accordance with the Environmental Code and the Nuclear Activities Act. There is so far no time plan for when the court will make its decision.

In this statement MKG will in the discussion of different issues refer to the scientific content and argumentation in the appeal and it is included as an appendix to the statement. The appeal includes 48 appendixes and some sub-appendixes that are also submitted as they provide an insight into the important background that the appeal is based upon¹². The appeal is in Swedish but as this is an official language in Finland it should be in accordance with the formal administrative consultation process.

2. The issue of the problem of the long-term integrity of the copper canister

The most important issue that needs to be taken into account when considering the license application is that there are very competent and distinguished corrosion scientists that have understood that copper is not a fully adequate canister material to guarantee long-term safety of the repository. Instead of only a few canisters starting to leak after 100 000 years most canisters could start to leak only after some hundreds of years.

This problem has been very clearly formulated in statements by scientists made in the Swedish review process of the license application for the repository for spent nuclear fuel. This led the Land and Environment Court in January 2018 to tell the government in a statement that this issue had to be examined and resolved before a decision to allow a license could be taken.

The government review did not include a thorough examination of the issue of the long-term integrity of the copper canister before the decision to approve the license application. In addition, new experimental information on copper corrosion from the LOT project was not treated with sufficient scientific rigour so as to allow proper inclusion of the results in the review process. In the end, the government decision ignored the court's statement and based the approval of construction of the repository only on statements from the nuclear regulator SSM. SSM in turn only based its opinion on the information provide by the nuclear waste company SKB. It is not clear whether the position of the nuclear regulator on the long-term safety of the repository is in accordance with the Environmental Code.

The Finnish government needs to independently and with proper rigour analyse this issue without prejudice and take into account not only the statements from the nuclear regulator STUK and the nuclear waste company Posiva Oy. The appeal

¹ Appendixes 1-6 are not included as they are simply proxies for the head environmental lawyer at the Swedish Society for Nature Conservation to represent the submitting organisations.

² Unfortunately, the registration system for submitting statements to the web site utlåtande.fi does not allow a registration from Sweden. Therefor all files are being submitted by e-mail. The 25 sub-appendixes belong to appendix 22.

that is included as an appendix to this statement holds the scientific information necessary to start such a review.

3. The issue of the importance of the copper canister barrier in the safety case

The reason that the Swedish nuclear regulator SSM repeatedly has stated that there is a possibility that the Swedish repository for spent nuclear fuel can provide sufficient long-term safety is that the copper canister is only one barrier in the concept. SSM is of the opinion that in a holistic view the combination of the copper canister as a barrier together with the barrier of the bentonite clay buffer surrounding the canister and the low permeability of bedrock as a third barrier provide adequate long-term safety.

It should however be noted that the third barrier only works if the tunnels and shafts in the repository are at least as impermeable to water flow as the rock, after closure of the repository. This has not so far been shown scientifically by experiments, but the model in the safety case assumes the clay or rock in the tunnels and shafts to be completely tight.

In addition, the barrier of the copper canister and the clay bentonite buffer barrier are not independent of each other. If the copper canister corrodes heavily, the clay buffer will be chemically affected and not swell and be tight to water as assumed in the safety case.

The nuclear waste company SKB and the nuclear regulator SSM base their understanding of the robustness of the safety case partly on modelling that shows that even if some copper canisters start to leak the long-term safety of the repository is only somewhat reduced. But this importantly is only the case if at least one of the other barriers works perfectly. This, that one barrier will always work perfectly, is something that has still to be shown to be the case.

The fundamental question that has to be answered in the review of the license application is how poor an understanding of how copper behaves in a repository environment can be allowed, while still being convinced that the multi-barrier system will provide enough long-term safety. Can almost any knowledge about problems with the long-term integrity of the copper canister be ignored?

Instead of ignoring copper canister issues, it would seem appropriate not licence the repository unless the copper canister can be shown to work as intended in the safety case. The canister is the most important barrier, sometimes called the king of the system. To allow the licensing of a repository for spent nuclear fuel without adequate knowledge about the long-term integrity of the copper canister would be a big mistake.

Finally, if it is not so important that the copper canister works, why not use a less expensive steel canister instead. A canister made out of the best steel that can be produced to optimise the resistance to the repository environment will, with high likelihood, be much better than to use copper as a canister material.

4. The difference between the Swedish and Finnish safety case with regard to the multi-barrier concept

Some important observations can be made on the difference of the function of the multi-barrier systems of the Swedish and Finnish repository system for spent nuclear fuel. The copper canister and the bentonite clay buffer around the canister are very similar in both concepts.

However, the third barrier, i.e., the tightness of the rock, is different and the Finnish concept has clear disadvantages. First of all, the permeability of the rock in Olkiluoto where the repository (Onkalo) has been built is much higher than the permeability of the rock at Forsmark where the Swedish repository is to be sited. Simply said, there are more and bigger cracks in the Finnish rock that allows a higher water flow through the rock itself.

But, as stated above, the rock barrier is only as well functioning in the model as the function of its weakest part. This may clearly be the tunnels and shafts where water may flow in grooves caused by so-called “piping” much easier than through the rock itself.

In the Swedish concept the deposition tunnels are to be filled with blocks of bentonite clay and the space between the blocks and the rock wall to be filled with clay pellets. The same will be done for all other tunnels and shafts in the whole system except perhaps for the parts closest to the surface where the choice of material has not been decided yet. In the Finnish concept the deposition tunnels are to be filled with pellets only and the other tunnels and shafts with a mixture of clay and rock.

Even though the scientific experimental knowledge that the Swedish clay blocks and pellets will work as intended – i.e., swell and close the tunnel entirely to water flow – is insufficient, it is clear the function of a pellets to work as expected as the only a filling material for a tunnel has even less experimental evidence. Also, whether a rock and clay-filled tunnel will have a low permeability to water flow can be questioned.

This can have serious consequences for the Finnish use of modelling of the multi-barrier system to explore long-term safety. It appears as the use of only the permeability of the rock as input in the modelling, without understanding that the water will instead flow through tunnels and shafts to the surface, is even more uncertain in the Finnish than the Swedish concept.

5. The importance of further research on the long-term integrity of the copper canister

In the appeal that is enclosed as an appendix the scientifically problematic handling of the copper corrosion analysis after the retrieval of two 20-year-old experimental packages in the LOT experiment from the Äspö Hard Rock Laboratory in 2019 is clearly shown. It is vital that the analysis of the last experimental package that remains in the experiment is entirely scientific, and that the Finnish nuclear regulator STUK works with the Swedish nuclear regulator SSM to ensure this. If the copper corrosion results from that package are scientifically

reported and analysed, they can provide important information on the long-term degradation of the copper canister.

The Finnish nuclear waste company Posiva Oy is carrying out new experiments with copper and bentonite clay in the experimental area in Onkalo. One of the problems of analysing the LOT experiment results regarding copper corrosion is that the Swedish nuclear waste company SKB did not measure how fast the oxygen in the experiment was consumed. This allows the company to claim that the abnormally extensive corrosion observed with pitting corrosion in the experiment is due to trapped oxygen, even though it is known from other experiments that this is very unlikely as oxygen is consumed fast in similar experiments after they are closed and started.

The Finnish government should ask for the information from Posiva Oy of how fast the oxygen has been consumed in the new experiments that they have started. Assuming that the company has not made the same “mistake” and not measured oxygen consumption in order to allow the same explanation of the corrosion to be used.

6. The lack of a plan to carry information into the future

Finally, MKG would like to state that the application should contain information on how Finland will work with the issue of bringing information about the nuclear fuel repository into the future. It is quite possible that if the repository is put into operation without its long-term safety being good enough, it will never be closed but will be subject to so-called rolling stewardship in the hands of many future generations of citizens.

Best regards,

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Appendix: “Ansökan om rättsprövning av regeringens beslut om anläggningar i ett sammanhängande kärnbränsleförvarssystem i Forsmark och Oskarshamn”, Naturskyddsföreningen m.fl., 27 April 2022 (with appendix 7-48 and 25 sub-appendixes to appendix 22)